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ABSTRACT

The use of an electronic feedback system, the Anonymous Audience Response System (AARS), in educational decision making is described, and the results of use studies in North Carolina are discussed. The AARS insures anonymity of an individual participant's responses, and at the same time, provides immediate feedback of the group's collective responses on any question under consideration. Seven procedural steps that can be taken in the development of a specific issue when AARS is used are identified. Research on the use of AARS by 18 North Carolina school districts is also examined. A total of 269 group participants and 18 group leaders used AARS in the 36 planning/decision-making meetings during 8 months. The research focused on participants' attitudes concerning certain features of group meeting settings incorporating use of electronic feedback. In addition, features of group meetings were compared for electronically aided meetings and traditional meetings. Findings include the following: medium and large school district members responded more favorably toward AARS and its use in decision making than did small district members, and further time/experience in using AARS produced less disagreement in participants' attitudes concerning the system and its use. (SW)

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UTILIZATION OF PARTICIPATORY ELECTRONIC TECHNOLOGY IN GROUP COMMUNICATION AND DECISION-MAKING PROCESSES

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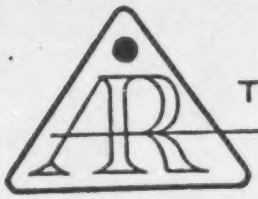

THE ASSOCIATION FOR INSTITUTIONAL RESEARCH

This paper was presented at the Twenty-Third Annual Forum of the Association for Institutional Research held at the Sheraton Centre in Toronto, Ontario, May 23-26, 1983. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum papers.

D. R. Coleman, Chairman
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ABSTRACT

During the past decade, an increasing number of participatory technological tools have been utilized to aid group communication and decision-making processes among various educational groups. One such tool, an electronic feedback system known as the Anonymous Audience Response System (AARS), has been used in research settings in a selected number of North Carolina school districts. This paper describes this type of technology, the research based upon its use, and major study findings and conclusions that would be of interest to professional educators.

UTILIZATION OF PARTICIPATORY ELECTRONIC TECHNOLOGY IN GROUP COMMUNICATION AND DECISION-MAKING PROCESSES

In view of the need for more sophisticated technological aids for group decision-making, the "Anonymous Audience Response System" (AARS) was developed. The AARS is an electronic feedback system, developed at Massachusetts Institute of Technology. The device insures anonymity of individual participant's responses, and at the same time, provides immediate feedback of the group's collective responses on any question under consideration.

The system consists of ninety hand-held voting consoles, each of which has ten switch positions (one for each digit from zero to nine). The consoles are connected to a central mini-computer which is, in turn, connected to a feedback display board. Figure 1 (Sheridan, 1973, p. 2) illustrates the component parts of the feedback system.

AARS can be incorporated into a group setting where alternatives to educational issues are to be discussed and decided upon by the group members. The following procedural steps (Sheridan, 1971, p. 50) can be taken in the development of a specific issue when AARS is used:

1. The leader describes the problem, specifies the question and describes the response alternatives from which respondents are to choose.
2. The leader explains what respondents must do in order to communicate their responses (Including, perhaps, their degree of understanding of the question, strength of feeling, and subjective assessment of probabilities).

Above: Hand-held voting console.

At Right: Alternate display board, major feedback display board, and mini-computer.

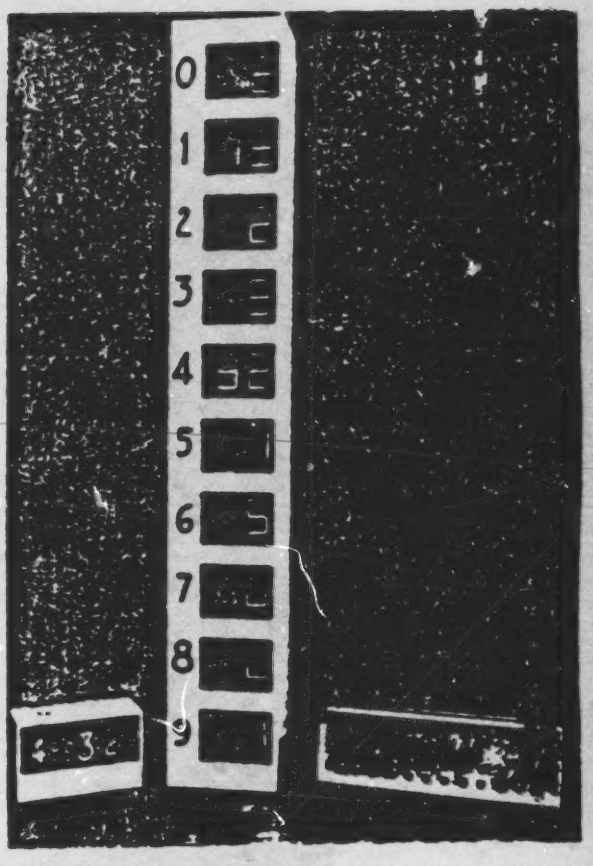

FIGURE 1. Component Parts of AARS.
(Source: Sheridan, T. Progress report of the MIT community dialog project. Report. Cambridge: Massachusetts Institute of Technology, 1973, p. 2.)

3. The respondents set into their voting boxes their coded responses.
4. The computer interrogates the voting boxes and aggregates the response data.
5. Preselected features of this response-aggregate are displayed to all parties.
6. The leader or respondents may request display of additional features of the response aggregate, or may volunteer corrections or additional information.
7. Based upon an a priori program, on previous results and/or results from respondents, the leader poses a new problem or question, restarting the cycle from Step 1.

Figure 2 (Garg, 1974, p. 181) schematically illustrates the application of these procedural steps to group settings using the electronic feedback system. As illustrated, group meetings using AARS not only make use of traditional verbal communication channels, but they can also utilize visual channels as well. The instant display of group results on the electronic feedback board comprises this form of visual communication within this type of meeting setting.

RELATED RESEARCH

Research on the use of AARS and other forms of participatory technology was conducted through the efforts of the Community Dialog Project of Massachusetts Institute of Technology and the Community Feedback Project of Duke University. These efforts were supported, in part, with a grant from

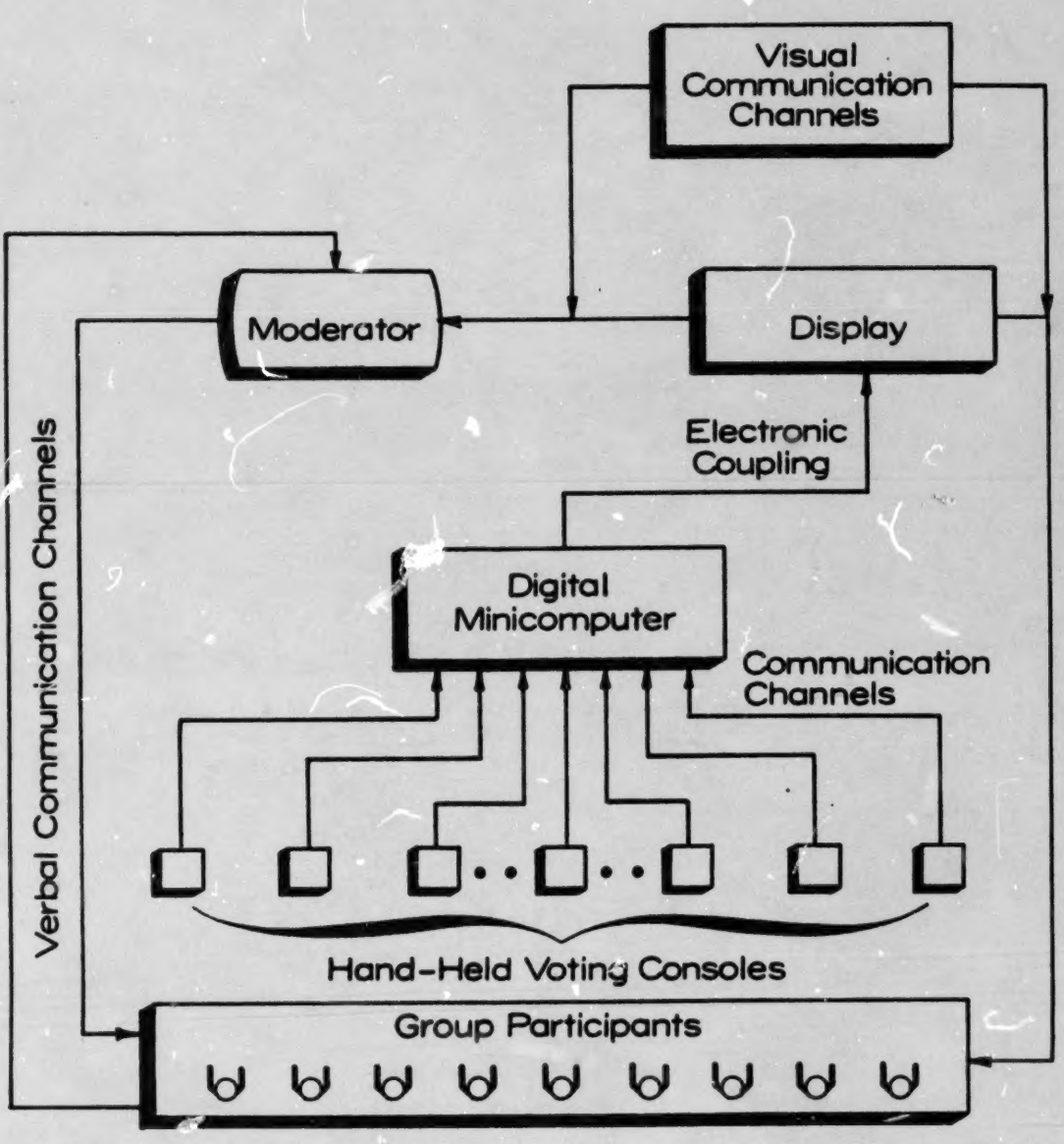

FIGURE 2. Schematic Diagram of the Group Feedback Process Utilizing AARS. (Source: Garg, D. Feedback optimization with a minicomputer-based audience response system. Proceedings of the Milwaukee Symposium on Automatic Control. Institute of Electrical and Electronics Engineers, 1974, p. 181.)

the National Science Foundation.

The Community Dialog Project began its efforts in the early 1970's under the direction of Dr. Thomas Sheridan at Massachusetts Institute of Technology. In an early report of the project, he (Sheridan, 1973, pp. 1-5) described the need for research in the area of mechanized citizen voting and group dialog, particularly since the processes have traditionally been viewed as separate from each other. In another report at Duke University's Community Feedback Project, Garg (1973, p. 12) reported that AARS had been used in a variety of research settings. These settings ranged from use by a high government official who asked school superintendents and principals what limits there should be on his own powers to a national professional society meeting that used the system as a means to obtain audience feedback to speaker presentations.

In another study (Lemelshtrich, 1973, p. 3), it was reported that the feedback technology facilitated many discussions on sensitive topics, but it did not seem to reduce the social pressures which created, in part, the need for such technology. Instead it provided a group communication link, which did not facilitate the close, interpersonal type of communication needed to reduce such pressure.

In a later report by Sheridan (1975, p. 473), successful use of AARS in test meetings was termed the Electronic Voting and Discussion Technique (EVDT). EVDT was termed useful, somewhat independent of group size and subject matter, and helpful, in delving into issues with greater speed and penetration. The most significant fact in the success or failure of EVDT meetings was the style of the group leader or moderator in his or her use

of the technology.

Roberts, Pittillo, and Garg (1978, p. 20) reported further use of the AARS system in a series of test meetings. In still another article the same authors (Garg et al, 1978, p. 297) introduced the use of electronic feedback in testing the steps of a decision-making model. They concluded that the system was more helpful in the final steps of decision-making (selection of the best solution and evaluation) than in the earlier steps (defining/analyzing the problem and delineating alternatives).

Research concerning similar or related types of participatory technology have also been reported in the literature. For example, Etzioni (1975, p. 27) described the work of the Multiple Input Network for Evaluating Reactions, Votes, and Attitudes (MINERVA) to include group participation via tele-conferencing in discussing issues of vital importance. The Televote Project (Campbell, 1974, p. 2) was another effort which provided for rapid two-way communication between public officials and large numbers of people (televoters) in the San Jose Unified School District in California.

METHODOLOGY

A total of eighteen North Carolina school districts participated in this study. The districts were geographically located throughout the state and were representative of three types of school districts, selected according to student membership.

I. Six small districts - less than 5,000 student membership.

II. Six medium districts - 5,000 to 15,000 student membership.

III. Six large districts - More than 15,000 student membership.

The basic design of experiments for the use of AARS and the collection

of data for studying its use took the following form (Garg et al, 1978, pp. 301-303):

1. School district was selected for possible inclusion in the study.
2. Contact was made with the district superintendent.
3. The school superintendent either agreed or declined for his district to participate. If the school superintendent disagreed, another district from that category was selected as a replacement.
4. The superintendent selected a central-office level planning/decision-making group to utilize AARS in two different meetings to be held successively in which decisions were to be made.
5. The research investigator met with the leader of the group in planning for inclusion of AARS in the development of the meetings.
6. AARS was used with each participating group for the two successive meetings; the time interval between the two meeting sessions with each group ranged anywhere from several days to several weeks.
7. At the conclusion of each of these meetings, the appropriate research questionnaires were administered to the group participants.

Upon completion of a total of thirty-six meetings (two for each of the eighteen participant school district groups), the relevant data

from the evaluation questionnaires were extracted and analyzed. A chi-square statistical analysis was performed to ascertain any significant differences in participant responses toward AARS.

ANALYSIS OF PARTICIPANTS AND MEETINGS

A total of 269 group participants and 18 group leaders used AARS in the 36 planning/decision-making meetings during an 8 month research period. An analysis of participants' background data obtained from the questionnaires revealed that of the total 269 participants in the study, 76 (28%) were from small districts, 127 (47%) were from medium-sized districts, and 66 (25%) were from large districts.

Eighty-seven (32%) of the participants were female and 182 (68%) were male. In the matter of age, a total of 113 (42%) were aged 40 years or below, 118 (44%) were aged 41 through 55 years, and 36 (14%) were of age 56 years or above.

In terms of educational background 13 (5%) of the participants held a doctorate degree. A total of 173 (65%) of the participants held a master's degree, while 47 (18%) held a bachelor's degree, and 35 (13%) held a sixth year certificate. Principals were the largest group represented at these meetings with 139 (52%) participating; in addition, there were 2 superintendents (1%), 21 assistant superintendents (8%), 69 central office staff personnel (25%), and 38 (14%) teachers and assistant principals.

A total of 83.4 hours of meeting time was used with the system in developing the decision-making phases. During this period, the system was used for voting 464 times. Thus, a composite of time and vote totals for 36 meetings comes to an average voting frequency of 13 for each 2.3 hours of meeting time.

Typical examples of topics discussed and voted upon in the thirty-six meeting sessions using the feedback system are:

- Adopting a school calendar
- Developing unit-wide management strategies
- Evaluating the grading and marking system of a district
- Discussing a potential merger of several school systems in which recommendations were voted upon for consideration by the board of education
- Evaluating a district's summer workshop for principals
- Evaluating a curriculum workshop held in a district
- Discussing and deciding on a list of survival skills necessary for students in grades K to 6
- Adopting a standarized testing program

RESULTS

This research has focused on an assessment of participant attitudes concerning certain features of group meeting settings incorporating use of electronic feedback. In addition, these features were assessed in a comparison of AARS meetings (electronically aided) with traditional ones (without electronic feedback).

Table 1 illustrates participant responses concerning the features of group meeting settings under consideration. These data are shown for two different meetings and are presented by small, medium, and large district personnel.

With respect to "Anonymity of Participants," an average of 82% of participants favored AARS in the first meeting compared to a slight

TABLE 1. COMPARISON OF PARTICIPANT'S RESPONSES ON UTILITY OF AARS OVER TWO SUCCESSIVE MEETINGS.

MEETING: / DISTRICT SIZE / MEETING FEATURE WITH AARS	MEETING #1					MEETING#2				
	Small	Medium	Large	Average	X^2 SIG. LEVEL	Small	Medium	Large	Average	X^2 SIG. LEVEL
ANONYMITY OF PARTICIPANTS	* 80	87	77	82	NS	76	86	76	81	NS
IMMEDIATE FEEDBACK OF RESULTS	67	89	77	80	‡ 14.55 (df=2) $p<.001$	79	82	83	82	NS
EFFICIENCY AND SPEED IN VOTING	62	75	61	68	NS	66	71	65	o8	NS
DISCUSSION OUTPUT	29	58	41	46	17.28 (df=2) $p<.001$	50	52	52	51	NS
OVERALL USE OF ELECTRONIC FEEDBACK IN COMMUNICATION	79	94	92	89	11.47 (df=2) $p<.01$	84	94	86	90	6.25 (df=2) $p < .05$

* Numerals in various cells represent percentage of total favorable responses from that school district category.

‡ Significance levels of X^2 are shown when $p < .05$.

decrease to 81% in the second meeting. There were no significant differences in X^2 values when small, medium, and large district personnel responses were compared.

As to "Immediate Feedback of Results," the participants favored the use of AARS with an average of 80% in the first meeting compared to a slight increase to 82% in the second meeting. Medium and large district personnel were more favorable than small district personnel in their responses to the system feedback, particularly in the first meeting where the X^2 value (14.55 with 2 d.f.) was significant at the . 001 level.

In the area of "Efficiency and Speed in Voting," an average of 68% of respondents favored AARS in both meetings. There were no significant differences in X^2 values.

As to "Discussion Output," AARS received its lowest average approval ratings, with 46% at the first meeting and 51% at the second. In the first meeting, small districts at 29% were significantly lower than medium at 58% or large districts at 41%, with X^2 (17.28 with 2 d.f.) being significant at the .001 level.

Within the context of overall use, 89% of all respondents favored the use of the feedback system at the first meeting and 90% at the second. Small district approval ratings of 79% and 84% for the two meetings were again significantly lower than the responses of medium and large district personnel. The X^2 value (11.47 with 2 d.f.) for first meeting results was significant at the .01 level. In addition, X^2 (6.25 with 2 d.f.) was significant at the .05 level for second meeting results.

In summary, as is evident from Table 1, respondents highly favored use of the system in meetings with regard to anonymity, immediate feedback, efficiency/speed in voting, and overall use in communication. As a trend, medium and large district personnel surpassed that of small districts in their support and approval of the system. In the matter of discussion output, however, respondents saw the least value of AARS in group meetings, again with small district personnel being the least supportive.

In addition, the respondents were asked to compare meetings in which AARS was used with the traditional meetings in which no such system was available. These data are presented in Table 2.

In the area of "Amount of Pressure Present While Voting," an average of 65% of all respondents favored the AARS meeting over the traditional setting. There seemed to be little difference among district personnel in their preferences within this area.

As to "Group Feedback of Results," again the electronically-aided meeting was preferred by a margin of 77% to only 7% for the traditional, while 16% saw no real difference in meeting settings. Small districts were significantly lower in favorable response compared to their medium and large district counterparts, and the X^2 value (10.23 with 2 d.f.) was significant at the .01 level.

Respondents seemed the most favorably inclined toward the system and view it as a distinct advantage in the matter of "Time Used for Voting and Reporting Results," with an 82% average for the AARS meeting. There were no significant differences among district personnel responses in the X^2 test of significance on this item.

TABLE 2. COMPARISON OF PARTICIPANT'S PREFERENCE OF MEETING MODES (MEETINGS WITH AARS VS TRADITIONAL)

MEETING MODE PREFERENCE / DISTRICT SIZE / MEETING FEATURE	WITH AARS				X^2	TRADITIONAL				NO DIFFERENCE			
	Small	Medium	Large	Average	SIG. LEVEL	Small	Medium	Large	Average	Small	Medium	Large	Average
AMOUNT OF PRESURE PRESENT WHILE VOTING	* 64	66	62	65	NS	11	23	15	18	25	11	23	18
GROUP FEEDBACK OF RESULTS	65	83	81	77	‡ 10.23 (df=2) $p < .01$	12	4	6	7	24	13	13	16
TIME USED FOR VOTING & REPORTING RESULTS	77	84	85	82	NS	8	9	6	8	15	7	9	10
DISCUSSION FLOW	32	51	46	44	7.06 (df=2) $p < .05$	17	17	11	15	51	32	44	40
TOTAL DISCUSSION OUTPUT	35	59	47	49	11.53 (df=2) $p < .01$	17	12	11	13	48	29	42	38

* Numerals in various cells represent percentage of total favorable responses from that school district category.

‡ Significance levels of X^2 are shown when $p < .05$.

Respondents seemed the least favorably inclined toward the system in its use to promote "Discussion Flow," with a total average of 44%. Again, the small district personnel, with 32% favorable responses, were the least impressed with the system's capability to promote discussion flow. This low percentage contrasted with a high of 51% for medium districts, which was significantly different at the .05 level when the X^2 test (7.06 with 2 d.f.) was performed.

In the final matter of "Total Discussion Output," the responses were only slightly higher than on the previous item with an average of favorable responses at 49% for the AARS meeting. Again, the small districts had the lowest favorable response with only 35% compared to a high of 59% for medium district personnel. The X^2 test (11.53 with 2 d.f.) showed this comparison to be significant at the .01 level.

In summary, the small district personnel seemed least favorably inclined on most aspects of system use in group settings. The greatest advantage perceived of the AARS meetings concerns time used for voting and reporting results, closely followed by group feedback of results and amount of pressure present while voting. The promotion of discussion flow and output are viewed as least advantageous aspects of the electronic feedback system when it is used in group meetings.

CONCLUSIONS

An analysis of the experimental results of the study to the following conclusions:

1. Medium and large district members were more favorable toward

AARS and its use in the decision-making process than were small district members; this could be explained in that small district personnel may initially know each other's views and the need for anonymity through a system, such as AARS would be decreased.

2. Further time/experience in using AARS produced less disagreement in participant's attitudes concerning the system and its use.
3. Participants found a variety of uses for the system in the decision-making process after further time/ experience in using the system.
4. In terms of the objectives of decision-making groups, usage of the system became more efficient within a single meeting and at later meetings, because of increased familiarity with the system and its capabilities.
5. Based on a comparison of participant's responses concerning experience in the AARS meeting versus experience in traditional planning/decision-making meetings without the system, the AARS meetings are more adequate in terms of: group feedback of results, amount of group pressure present while voting, and the time expended for voting and tabulation of results; however, there is no decided difference between the two types of group settings in terms of:

discussion flow, and discussion output.

6. The major advantages that participants found in using AARS in decision-making meetings were: anonymity, removal of possible group pressure, immediate feedback, and increased speed in voting.
7. The major disadvantages that participants found in using AARS in decision-making meetings were: rushed decision-making, lack of knowledge of individual opinion, physical problems with system set-up, and lack of discussion (especially with initial use).

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